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Engineering Design File

PROJECT NO. 23833

OU 7-13/14 In Situ Grouting Project Fire Protection

INEEL
Idaho National Engineering and Environmental Laboratory

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EDF No.: 5054 EDF Rev. No.: 0 Project File No.: 23833

1. Title: OU 7-13/14 In Situ Grouting Project Fire Protection

2. Index Codes:
   Building/Type: WMF-700 Subsurface Disposal Area SSC ID: N/A Site Area: Radioactive Waste Management Complex

3. NPH Performance Category: _____ or ☒ N/A

4. EDF Safety Category: _____ or ☒ N/A SCC Safety Category: Consumer Grade or ☒ N/A

5. **Summary:**

The approach of this engineering design file (EDF) is to identify the necessary features to provide facilities and operations protection from fire in accordance with Department of Energy (DOE) orders. These DOE orders incorporate the National Fire Protection Association Standards and the International Building Code. The intent of the DOE orders is to provide a level of protection that is characterized as "highly protected" or "improved risk." This is a level of fire protection that fulfills the requirements of the best-protected class of industrial risks.

Purpose:
This EDF describes the fire protection features for the design of the proposed facilities, equipment, and operations for the In Situ Grouting (ISG) Project.

Scope:
The scope of this EDF is to identify the fire protection design requirements, issues, and features that need to be considered for Phase 2 of the ISG Project.

Conclusions:
This EDF identifies and discusses fire protection design criteria applicable to the ISG Project that will take place in the Subsurface Disposal Area at the Radioactive Waste Management Complex (RWMC). These design criteria were discussed and coordinated with the RWMC fire protection engineer. A fire hazard analysis is scheduled that will document and gain acceptance for the fire protection program for this project.

The fire protection design criteria are identified to assist the subcontractor in planning and preparing for this work. Compliance with DOE fire protection requirements can be achieved in many different ways. Compliance can be achieved through a combination of installed fire suppression and detection systems, and implementation of a fire prevention program. Identification of the design criteria is provided to enable the subcontractor to determine the most efficient manner for satisfying these requirements.

Recommendations:
The following recommendations support the fire protection program for the ISG Project:
1. Prepare a fire hazard analysis to document and gain approval for the fire protection features (i.e., design and operations) of this project. In the absence of a fire hazard analysis, the design requirements from this EDF need to be included in the performance bid package.
2. Based on the remote location and lack of utility systems, it is recommended the facilities and operations be designed so that fire sprinkler systems, fire alarm systems, and fire hydrants are not required.
3. As specialized project equipment, each trackhoe needs to be protected from the effects of a fire.

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(See instructions for definitions of terms and significance of signatures.)

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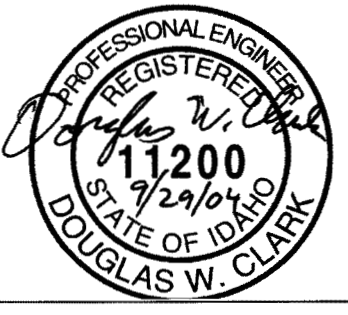

CONTENTS

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ACRONYMS

DOE	Department of Energy
EDF	engineering design file
FM	Factory Mutual
HPR	highly protected or improved risk
INEEL	Idaho National Engineering and Environmental Laboratory
ISG	in situ grouting
LST	list
NFPA	National Fire Protection Association
PDSA	Preliminary Documented Safety Analysis
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
SSC	structure, system, and component
TFR	technical and functional requirements
UL	Underwriters Laboratory

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OU 7-13/14 In Situ Grouting Project Fire Protection

1. PURPOSE

This engineering design file (EDF) describes the fire protection features for the design of the proposed facilities, equipment, and operations for the In Situ Grouting (ISG) Project.

2. BACKGROUND

The ISG Project is planned to occur in the Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex (RWMC). The SDA is a landfill that contains buried low-level radioactive wastes and other mixed wastes contained in concrete vaults. Minimal utility systems are extended out on or around the SDA. The long-term plan for the SDA is to cover the entire area with a concrete cap to prevent the infiltration of naturally occurring water, rain, and snow melt.

List (LST)-268, "INEEL Nuclear Facility/Nuclear Facility Manager List," lists the SDA as a nuclear facility. Facilities that are constructed outside the SDA are not expected to be classified as nuclear facilities. Radiation control program measures apply to minimize personnel exposure and control the spread of contamination.

The Preliminary Documented Safety Analysis (PDSA) for ISG in the SDA is documented in Idaho National Engineering and Environmental Laboratory (INEEL)/EXT-03-00316, *Feasibility Study Preliminary Documented Safety Analysis for In Situ Grouting in the Subsurface Disposal Area*. The scope of this PDSA includes grouting in all areas of the SDA. Drums containing materials that present a potential fire or explosion hazard are buried in some of the pits in the SDA. Analysis determined that the occurrence of a fire or explosion in the buried waste is extremely unlikely. No evaluation guidelines were exceeded. No safety structures, systems, and components (SSCs) or technical safety requirements were necessary to mitigate the consequences of a fire or explosion.

The approach of this EDF is to identify the necessary features to provide facilities and operations protection from fire in accordance with Department of Energy (DOE) orders. The DOE orders incorporate the National Fire Protection Association (NFPA) Standards and the International Building Code. The intent of the DOE orders is to provide a level of protection that is characterized as "highly protected" or "improved risk" (HPR). This is a level of fire protection that fulfills the requirements of the best-protected class of industrial risks.

DOE Order 420.1A, "Facility Safety," requires the preparation of a fire hazard analysis for all nuclear facilities to evaluate and identify controls to minimize the risk of fire. At this early stage of the project, the fire hazard analysis has not been prepared. The project approach and information presented in this EDF have been discussed and coordinated with the RWMC facility fire protection engineer. In the absence of a fire hazard analysis, the requirements identified in this EDF need to be incorporated into the performance package.

3. SCOPE

The scope of this EDF is to identify the fire protection requirements, issues, and features that need to be considered for Phase 2 of the ISG Project. This project is planned to occur in the SDA at RWMC.

4. REQUIREMENTS

The requirements of Technical and Functional Requirements (TFR)-267, "Requirements for the OU 7-13/14 In Situ Grouting Project (Project, Customer, and System)," were reviewed to support the preparation of this EDF. The project and system performance requirements did not contain any fire protection requirements.

5. SYSTEM CLASSIFICATIONS, CATEGORIZATIONS, AND DETERMINATIONS

As documented in INEEL/EXT-03-00316, the fire protection features and systems for this project are not required to prevent the evaluation guidelines from being exceeded. No fire protection systems or equipment are designated as safety-class or safety-significant SSCs.

6. ASSUMPTIONS

The following are assumptions for the fire protection program for the ISG Project:

- A fire hazard analysis will be prepared to identify and gain acceptance of the fire protection requirements for this project.
- No safety SSCs or technical safety requirements are necessary to mitigate the consequences of a fire or explosion.
- Facilities and operations can be designed so that fire suppression and detection systems, and fire hydrants are not required by DOE orders.

7. DESIGN CRITERIA

7.1 Applicable Design Codes and Standards

- DOE orders:
  - DOE O 420.1A
  - DOE O 440.1A, "Worker Protection Management for DOE Federal and Contractor Employees"
  - DOE-STD-1088-95, "Fire Protection for Relocatable Structures"
  - DOE-STD-1066-99, "Fire Protection Design Criteria."
- DOE-Idaho Architect and Engineering Standards:
  - Division 13—Special Facilities
  - Appendix K, "Standard for Trailers, Modular Buildings, and Relocatable Structures."
- International Building Code (currently enforced edition)

- NFPA Standards:
  - NFPA 13, "Installation of Sprinkler Systems"
  - NFPA 30A, "Automotive and Marine Service Station Code"
  - NFPA 70, "National Electrical Code"
  - NFPA 72, "National Fire Alarm Code"
  - NFPA 101, "Life Safety Code"
  - NFPA 801, "Standard for Fire Protection for Facilities Handling Radioactive Materials."
- Factory Mutual (FM) Datasheet:
  - 7-40, "Heavy Duty Mobile Equipment."

7.2 System Design Requirements

7.2.1 General

The project facilities and operations shall be provided with a level of fire protection to meet the DOE fire protection objectives. The features and systems necessary to control a design basis fire shall be defined by the fire hazard analysis. The RWMC facility fire protection engineer is responsible for preparing a fire hazards analysis for the project.

The project shall be designed, constructed, operated, and maintained in a manner that minimizes the occurrence of fires and explosions.

The project shall be capable of mitigating the consequences of design basis fires as demonstrated by the fire hazards analysis.

The facilities and equipment shall be designed to use and be constructed of noncombustible or fire-resistant materials, where practical.

The project shall use Underwriters Laboratory (UL)-listed and/or FM-approved materials, appliances, or devices for the intended application, where applicable.

7.2.2 Firewater System Discussion

A firewater system is not currently provided in the SDA or around the SDA to supply sprinkler systems or provide firewater for fire department use. Based on the remote location, use of relocatable structures, and lack of a water supply (in the SDA and south of the SDA), it is recommended the facilities be designed so that fire sprinkler systems and fire hydrants are not required. The size, value, and operation of the project facilities may be controlled so that the requirements for fire suppression systems and fire hydrants are not invoked by the DOE orders.

The facilities proposed to support this project are not large enough in area or value, or critical to project performance, to invoke the HPR criteria to provide a firewater supply. The HPR philosophy will

be incorporated by the use of other fire protection features, such as the use of noncombustible construction, separation of buildings, and separation from the wild land vegetation.

The following discussion provides a summary of key DOE requirements for automatic fire suppression systems and fire hydrants. This summary is not all inclusive of the DOE requirements.

For permanent facilities DOE requires an automatic fire suppression system for any facility with the following:

- An area of 5,000 square ft or greater
- Any facility with a fire loss (dollar value) of $1 million or greater
- Any facility that contains critical or long procurement items.

Relocatable structures use these same criteria with the following additions:

- Temporary facilities used as a control center for a vital activity
- In all facilities where a fire will affect a vital program for a period longer than acceptable as specified by the Program Senior Official (DOE)
- In a structure where the quantities of hazardous materials exceed the limits delineated in the International Fire Code
- In facilities used for sleeping quarters.

However, the DOE standard for Relocatable Structures provides the following exceptions:

- A limited supply suppression system may be used where a reliable water supply is not available
- Automatic sprinkler systems are not required in fabric or membrane type structures where an acceptable level of protection is provided by alternate means (i.e., a Fire Prevention Program and Fire Department response).

The DOE Standard for Relocatable Structures does not require fire hydrants for relocatable structures that are:

- Required to be mobile or are moved on a regular basis to support an operation
- Under 5,000 square ft, or when the fire loss is less than $1 million
- Remote structures as approved by the DOE authority having jurisdiction.

A firewater supply system is not currently installed in the SDA or in the area south of the SDA proposed for this project. The INEEL Fire Department response to emergencies in the SDA includes a 2,000-gal water tender as a water supply. Extending the existing RWMC firewater system to these areas would be a significant expense. With the proper planning and foresight, the facilities and operations for the ISG Project can be designed so that automatic fire suppression systems and fire hydrants are not required.

7.2.3 Facilities

The project design approach is to minimize locating any fixed or relocatable structures in the SDA. This approach is taken in accordance with the company As Low As Reasonably Achievable program and because of the lack of utilities in the SDA. Support facilities are planned to be located on the south side of the SDA. See EDF-5144, "OU 7-13/14 In Situ Grouting Project Support Facilities," for additional information.

Facilities at the INEEL are designed in accordance with the International Building Code, DOE orders, NFPA Standards, and the DOE-Idaho Architect and Engineering Standards. DOE-STD-1088-95 provides additional design criteria for relocatable structures, including mobile homes, trailers and semi-trailers, and tent/membrane structures. The following requirements are applicable to this project and the proposed facilities:

1. Membrane type structures should be constructed of tentage material that is either noncombustible or flame-resistant as tested (large scale) and approved for the anticipated use. The use of noncombustible materials is preferred.

2. A means to notify the fire department of an emergency will be required. For remotely located facilities, notification by telephone is an accepted method.

3. A means to notify and evacuate the building occupants in the event of a fire is required by the DOE orders. For facilities the size and occupancy proposed by this project, the International Building Code and the Life Safety Code (i.e., NFPA 101) do not require a fire alarm system to notify the occupants of a fire. Building occupant notification would be performed by local occupant voice announcement.

4. Portable fire extinguishers will be required in all facilities and equipment in accordance with NFPA 10, "Portable Fire Extinguishers."

5. Interior finishes will be UL-listed with a flame spread rating under 25 and smoke developed rating of less than 50.

6. Line the underside of the trailers with 18 ga sheet metal or noncombustible materials to minimize the accumulation of combustible debris.

7.2.4 Equipment

7.2.4.1 Trackhoe Drilling Rig. The drilling rig will be a roto-hammer drill mast attached to the boom of a diesel-powered trackhoe. A trackhoe is a mobile piece of heavy construction equipment that will be operating in the SDA. This equipment will be operated and stored outdoors. During the off-season, the trackhoe will be moved out of the SDA and stored outside.

The trackhoe is commercially available equipment that is used in general industry. The drill mast is commercially available, but will be customized to support the special requirements for this project. This modified equipment is specific to the project performance and may not be readily replaceable.

FM Datasheet 7-40 identifies criteria to reduce fire losses associated with heavy mobile equipment, such as the trackhoe. This datasheet specifies the following requirements:

- A fixed automatically actuated multipurpose dry chemical extinguishing system will protect the engine compartment.
- Where practical, the hydraulic fluid will be an FM-approved less-flammable fluid.
- If a FM-approved less-flammable hydraulic fluid is not used, a pre-engineered fixed automatically actuated multipurpose dry chemical extinguishing system shall protect areas where ignition of hydraulic fluid is possible.
- Means to manually activate the system will be provided in the operator's compartment and at an outside location that is accessible from the ground. The system shall be interlocked to shutdown the engine and hydraulic system when the suppression system activates.
- At least one 20-lb multipurpose dry chemical fire extinguisher shall be provided on each vehicle.

The incorporation of these requirements needs to be evaluated by the fire hazard analysis.

7.2.4.2 Grout Delivery Trucks. The trucks used to transport the grout from the batch plant to the grout injection site will be concrete mixer trucks as indicated by EDF-5162, "OU 7-13/14 In Situ Grouting Project Support Vehicles." These trucks are commercially available, and no specialty features are necessary to support this project. A replacement truck should be readily available to maintain the project schedule if one is damaged. Each truck should contain a fire extinguisher, but no automatic suppression systems are required.

7.2.4.3 Grout Batch Plant (off the SDA) and Supply System (in the SDA). The grout batch plant will be an unenclosed outdoor operation. The grout supply system will consist of silos, mixers, possible delivery trucks or train cars, low and high-pressure pumps, and distribution lines. No fire protection design issues are anticipated for the Grout Batch Plant.

8. RISKS

The following were determined to be risks of the fire protection program for the ISG Project:

1. The fire hazard analysis for this project has not been written or approved. The fire hazard analysis will document and gain acceptance of the fire protection requirements for this project.
2. A firewater supply system is not provided in the areas proposed for this project.
3. The RWMC emergency notification system does not provide coverage in the areas proposed for this project.

9. LOGISTICS SUPPORT

1. Reporting of emergency events: The subcontractor will need to establish a procedure for the reporting of emergency events (e.g., medical, fire, and vehicle accident). If an emergency occurs at the ISG Project, the subcontractor must notify the INEEL Fire Department (dial 777 for site locations) and the RWMC Shift Supervisor (526-2767).

2. RWMC Emergency Communication to the ISG Project: A procedure will need to be developed for RWMC Operations to notify the ISG subcontractor of plant-wide emergencies (e.g., take cover and evacuate).

3. The INEEL Fire Department will need to prepare a pre-incident plan to address emergency response to the ISG Project facilities and operations.

10. CONCLUSION

This document identifies and discusses fire protection design criteria that are applicable to the ISG Project that will take place in the SDA at RWMC. These design criteria were discussed and coordinated with the RWMC fire protection engineer. A fire hazard analysis is scheduled that will document and gain acceptance for the fire protection program for this project.

The fire protection design criteria are identified to assist the subcontractor in planning and preparing for this work. Compliance with the DOE fire protection requirements can be achieved in many ways. Compliance can be achieved through a combination of installed fire suppression and detection systems, and implementation of a fire prevention program. Identification of the design criteria is provided to enable the subcontractor to determine the most efficient manner for satisfying these requirements.

11. RECOMMENDATIONS

The following were determined to be recommendations of the fire protection program for the ISG Project:

1. Prepare a fire hazard analysis to document and gain approval for the fire protection features (i.e., design and operations) of this project. In the absence of a fire hazard analysis, the design requirements from this EDF need to be included in the performance bid package.

2. Based on the remote location and lack of utility systems, it is recommended to design the facilities and operations so that fire sprinkler systems, fire alarm systems, and fire hydrants are not required.

3. As specialized project equipment, each trackhoe needs to be protected from the effects of a fire.

12. REFERENCES

DOE-Idaho Architect and Engineering Standards.

DOE O 420.1A, Facility Safety.

DOE O 440.1A, Worker Protection Management for DOE Federal and Contractor Employees.

DOE-STD-1066-99, Fire Protection Design Criteria.

DOE-STD-1088-95, Fire Protection for Relocatable Structures.

EDF-5144, OU 7-13/14 In Situ Grouting Project Support Facilities.

EDF-5162, OU 7-13/14 In Situ Grouting Project Support Vehicles.

FM Datasheet 7-40, Heavy Duty Mobile Equipment.

INEEL/EXT-03-00316, Feasibility Study Preliminary Documented Safety Analysis for In Situ Grouting in the Subsurface Disposal Area.

International Building Code (currently enforced edition).

LST-268, INEEL Nuclear Facility/Nuclear Facility Manager List.

NFPA 10, Portable Fire Extinguishers.

NFPA 13, Installation of Sprinkler Systems.

NFPA 30A, Automotive and Marine Service Station Code.

NFPA 70, National Electrical Code.

NFPA 72, National Fire Alarm Code.

NFPA 101, Life Safety Code.

NFPA 801, Standard for Fire Protection for Facilities Handling Radioactive Materials.

TFR-267, Requirements for the OU 7-13/14 In Situ Grouting Project (Project, Customer and System).